



## Observational study

# Diabetes mellitus and hyperlipidaemia as risk factors for frequent pain in the back, neck and/or shoulders/arms among adults in Stockholm 2006 to 2010 – Results from the Stockholm Public Health Cohort



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## HIGHLIGHTS

- Hyperlipidaemia may be associated with the risk of back, neck and/or shoulder pain.
- Diabetes may be a risk factor for back, neck and/or shoulder pain among men.
- Metabolic conditions may be associated with the risk of musculoskeletal pain.

## ARTICLE INFO

## Article history:

Received 26 August 2016

Received in revised form 28 October 2016

Accepted 13 November 2016

## Keywords:

Diabetes mellitus

Hyperlipidaemia

Back pain

Neck pain

Shoulder pain

## ABSTRACT

**Background and aims:** Frequent back, neck and/or shoulder pain (BNSP) are common conditions which pose high burden for the society. Results from previous studies suggest that diabetes and hyperlipidaemia may be associated with a higher risk of getting such conditions, but there is in general, few studies based on longitudinal designs. The aim of this study was therefore to compare the risk of developing frequent BNSP in men and women with and without diabetes and/or hyperlipidaemia.

**Methods:** A longitudinal study based on the Stockholm Public Health Cohort was conducted based on subjects aged 45–84, who were free from pain at the mentioned sites in 2006 and followed up until 2010. The data in the current study is based on questionnaires, except socioeconomic status which was derived from Statistics Sweden. The exposure diabetes and hyperlipidaemia was self-reported and, a categorical variable was created; without any of the conditions, with hyperlipidaemia only, with diabetes only and with both conditions. The outcome frequent BNSP was defined using the following questions in the questionnaire in 2010: “During the past 6 months, have you had pain in the neck or upper part of the back?”, “During the past 6 months, have you had pain in the lower back?”, and “During the past 6 months, have you had pain in the shoulders/arms?”. All questions had three possible response options: no; yes, a couple of days per month or less often and; yes, a couple of days per week or more often. Those who reported weekly pain to at least one of these questions were considered to having frequent BNSP. Binomial regressions were run to calculate the crude and adjusted risk ratio (RR) in men and women separately. Additional analysis was performed in order to control for potential bias derived from individuals lost to follow-up.

**Results:** A total of 10,044 subjects fulfilled the criteria to be included in the study. The mean age of the sample was 60 years and evenly distributed by sex. After adjusting for age, body mass index, physical activity, high blood pressure and socioeconomic status, the RR for frequent BNSP among men with diabetes was 1.64 (95% CI: 1.23–2.18) and 1.19 (95% CI: 0.98–1.44) for hyperlipidaemia compared to men with neither diabetes nor hyperlipidaemia. Among women the corresponding RRs were 0.92 (95% CI: 0.60–1.14) and 1.23 (95% CI: 1.03–1.46). Having both diabetes and hyperlipidaemia at baseline was not associated with increased risk of frequent BNSP. Diabetes and hyperlipidaemia seems to be associated

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with an increased risk for frequent BNSP and the risk may differ between men and women. Behaviours and/or biological underlying mechanisms may explain the results.

**Conclusions:** This study suggests that metabolic diseases such as diabetes and hyperlipidaemia may have an impact on the pathophysiology of frequent BNSP and thus, contributes to the knowledge in musculoskeletal health. Furthermore, it confirms that men and women may differ in terms of risk factors for BNSP.

**Implications:** Health professionals should contemplate the results from this study when planning primary prevention strategies.

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## 1. Introduction

Pain in the back and the neck represents a high burden for the healthcare systems, the society and individuals with the conditions, especially in developed countries, where its occurrence has increased in the past years positioning it now as one of the top contributors of disability adjusted life years [1]. Data from various studies have reported prevalence of between 4.4% and 13% for neck pain [2–4] and between 10.8% and 21.1% for back pain in the past 3 months [5]. The back and neck region involve multiple structures, all of them being potentially prone to suffer from injuries and/or pain of diverse origin [6,7] and when it comes to neck pain, the shoulder region is often involved.

Various authors have investigated the aetiology of pain in these three sites, having in common that none of them have found strong associations, making frequent back, neck and shoulder pain (BNSP) a relatively unexplored area of knowledge in which biological and environmental factors are to be considered. Among the reported risk factors for these conditions are female sex [8], older age [4], smoking [9], high job strain and job characteristics [10], high body weight [11], previous episodes of pain [10], psychological stress [12,13] and depression [14]. In addition, previous studies based on the Stockholm Public Health Cohort (SPHC) indicate that physical inactivity [15,16] and income [17] may be associated as well. Given that nowadays it is well accepted that multidisciplinary is fundamental when it comes to the prevention and treatment of these conditions [18], a widened knowledge of risk factors may support new approaches.

Furthermore, results from previous cross-sectional studies indicate higher occurrence of pain of musculoskeletal origin among individuals with cardiovascular conditions such as atherosclerosis, high blood lipids, diabetes and glucose intolerance [5,19–21] but these associations have been scarcely explored in longitudinal studies [22,23]. Different explanations have been proposed as the link between cardiovascular conditions and pain, among them, the occlusion of lumbar or sacral arteries for the case of high blood lipids [18], deleterious effects of advanced glycation end products in the intervertebral discs [24,25], and inflammatory and immune responses originated by either mechanical or chemical insults [26]. Similarly, diabetes and hyperlipidaemia have been linked with inflammatory biomarkers such as TNF- $\alpha$  [27,28]: it is likely that the tissues of the musculoskeletal system can be target of such inflammation processes derived from the mentioned diseases.

The aim of this study was to compare the risk of developing frequent BNSP in men and women with and without diabetes and/or hyperlipidaemia; and based on that, contribute to the knowledge regarding the aetiology of musculoskeletal pain.

## 2. Material and methods

### 2.1. Study population

This cohort study is based on data from the Stockholm Public Health Cohort (SPHC), in which a postal and web based

questionnaire that collects information from a random sample of the general population between 18 and 84 years in Stockholm was used. In 2006, 19,301 individuals aged between 45 and 84 participated in the study; 4 years later a follow-up survey was sent, which was answered by 15,290 (response rate 79%). The survey was available in six languages apart from Swedish in order to capture the actual distribution of the population in Stockholm [29].

For the present analysis, subjects who had responded both in 2006 and 2010, being above 45 and up to 84 year and who were free from frequent BNSP pain were included. Participants were then classified as exposed or unexposed based on self-reported information on high blood lipids and diabetes mellitus. The above-mentioned age limit was set because the prevalence of diabetes and hyperlipidaemia is known to be uncommon among younger people. The selection of the study population, was further based on two questions in the 2006 questionnaire: “During the past 6 months, have you had pain in the neck, shoulders or arms?” with five possible answers: no; yes, a couple of days in the past half year; yes, a couple of days per month; yes, a couple of days per week or; yes, every day. The same formulation was used to ask about low back pain. These two variables were combined so that those individuals who answered any of the three first options of answers to both questions formed the study population that was followed for 4 years, and thus constitute the study base ( $n = 10,044$ ).

### 2.2. Exposure and outcome definitions

Individuals with diabetes or hyperlipidaemia were identified using the question: “have you received any of the following diagnosis by a doctor?” Additionally, the person's age at diagnosis was asked. Both exposures were combined to create four categories: those without any of the conditions, those with only hyperlipidaemia, those with only diabetes and those with both diabetes and hyperlipidaemia. In 2010, the outcome frequent BNSP was defined using the following three questions: “During the past 6 months, have you had pain in the neck or upper part of the back?”, “During the past 6 months, have you had pain in the lower back?”, and “During the past 6 months, have you had pain in the shoulders/arms?”. All questions had three possible response options: no; yes, a couple of days per month or less often and; yes, a couple of days per week or more often. Those who reported weekly pain to at least one of these three questions were considered as having frequent BNSP.

### 2.3. Confounders

The following potential confounders were selected from the questionnaire in 2006 based on its relevance: age, socioeconomic status, body mass index (BMI), physical activity level, smoking habits, receiving treatment for high blood pressure, alcohol intake and psychosocial stress. Socioeconomic status was categorized according to the information from Statistics Sweden based on occupation and education [30]. Physical activity level was self-reported and dichotomized as regular and not regular referring to the past 12 months. Smoking habits was categorized as

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